

Appendix H2

**Refining WAG ERA Contaminants
of Ecological Concern for the OU 10-04 Site-Wide Ecological
Risk Assessment**

TABLES

H2-1. Evaluation and selection of COPCs summarized from the WAG ERAs for use in the OU 10-04 ERA (from Suter et al. 1995).....	H2- 33
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Appendix H2

Compilation of WAG Ecological Risk Assessment Results

A primary requirement for the Operable Unit (OU) 10-04 Ecological Risk Assessment (ERA) problem formulation is to compile and evaluate results from individual Waste Area Group (WAG) ERAs. The WAG-level ERAs are the second phase in a three-phase approach in the Idaho National Engineering and Environmental Laboratory (INEEL) ERA process; the third phase is the OU 10-04 assessment. Compiling and evaluating the WAG ERA results will identify the following:

1. Contaminants of potential concern (COPCs) to be assessed for OU 10-04
2. INEEL ecological receptors exposed to those COPCs
3. Source, extent, and distribution of individual COPCs across the INEEL
4. Additional WAG-level gaps in information or data that must be filled prior to conducting the OU 10-04 ERA.

This white paper follows the methodology presented in Appendix D1, Attachment 1, of the OU 10-04 Work Plan (DOE-ID 10554, 1999). As discussed in the OU 10-04 Work Plan, the four major steps performed were:

1. **Summarizing Hazard Quotients (HQs) > 1 for each COPC, across sites within each WAG (average and maximum).** The average HQs will be determined by summing the HQs by contaminant and receptor for all sites within the WAG demonstrating concentrations above ecologically based screening levels (EBSLs) and background levels and dividing by the number of sites. The maximum HQs will be found by comparing the data across each of the sites in a WAG and taking the maximum value for each receptor (individual species or functional group). The maximum HQ represents the highest calculated for that contaminant. Summaries of average and maximum HQs within WAGs 1, 2, 3, 4, 5 and 9 for organic and miscellaneous inorganics COPCs, and metallic COPCs are included in Attachments H2-1 and H2-2 of this appendix, respectively.
2. **Summarizing receptors for which HQ > 1 by contaminant and identifying receptors for which HQs could not be calculated (COPC/receptor combinations across WAGs).** After summaries have been completed for all WAG ERA results, HQs will be compiled for each COPC/receptor combination for each WAG. The summary of COPCs by functional group and selected receptor for both average and maximum HQs > 1 across WAGs are presented in Tables H2-3-1 and H2-3-2 in Attachment H2-3 of this appendix. The summary tables by COPC are also included in this appendix. Receptors and COPCs that could not be assessed due to lack of either toxicity data and/or exposure parameters were carried through the summary process and evaluated qualitatively in the OU 10-04 ERA.
3. **Refining and ranking WAG COPCs to produce a preliminary OU 10-04 ERA COPC list.** The list of COPCs that were not eliminated in Step 1 was subjected to a ranking/screening procedure to prioritize COPC/receptor combinations for the OU 10-04 assessment. This list of COPCs was reduced and prioritized based on a modification of the approach used by Oak Ridge National Laboratory (Suter et al. 1995). This included evaluating whether a COPC occurs at multiple WAGs or other locations at the INEEL. The

higher priority was given to those contaminants that are present at more than one WAG at the INEEL. Each contaminant was also assessed for volatility, environmental degradation, persistence, and bioavailability/ bioaccumulation. Those COPCs with high volatility, rapid environmental degradation, low persistence, and low bioavailability were evaluated for elimination from the list. COPCs with low volatility, slow degradation, high persistence, and high potential for bioaccumulation will be evaluated for retention. The results of this process are presented in Table H2-1.

4. **Screening WAG COPCs with HQs > 10 to produce the final OU 10-04 ERA COPC list.** Ranges of HQs may be expressed as orders of magnitude reflective of the increasing levels of severity for unacceptable ecological risks. For example,

- 1-10, where 10 represents one order of magnitude
- 10-100, where 100 represents 2 orders of magnitude
- 100 – 1000, where 1000 represents three orders of magnitude, and
- > 1000

The purpose of eliminating contaminants with HQs below 10 was to focus the ERA at the most contaminated sites and risk drivers. If a contaminant was considered toxic, persistent, or bioaccumulative, it was retained regardless of whether the HQs were below 10. On a site-wide basis, HQs up to 100 may represent the inherent uncertainty in the risk assessment process and not necessarily indicate unacceptable risks. This is possible due to the differences in the sites themselves, data sets, time frames, sampling depths, soil types, and many other variables. The sampling results typically vary from one sampling event to another and between laboratories and selection of analytical methods. Consideration was also given as to the number of contaminants at a site which showed multiple HQ exceedances. Multiple contaminants at a site may indicate the potential for other potential contaminants, which were not sampled. This was meant as a conservative measure. With careful consideration of the various factors and uncertainty used to obtain the HQs, professional judgement was also used in the selection of a screening HQ at one half the range of 1 to 100.

Table H2-1. Evaluation and selection of COPCs summarized from the WAG ERAs for use in the OU 10-04 ERA (from Suter et al. 1995).

Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
Inorganics				
Arsenic	1,2,3,4,5, 9	18 of 51 receptor categories had HQs>=1	Yes	No HQs>50 from WAG ERAs but toxic and common contaminant at CERCLA sites.
Aluminum	1,3,4,5,9	29 of 51 receptor categories had HQs>=1	No	EPA (2000) maintains elimination as a COPC unless soil pHs are < 5.5.
Antimony	1,2,3,4,5, 9,6/10	11 of 51 receptor categories had HQs>=1 ^a	Yes	ATSDR 1992; toxic; low bioaccumulation potential
Barium	1,2,3,4,9, 6/10	15 of 51 receptor categories had HQs>=1 ^a	Yes	Not considered toxic in most doses; acts as a laxative in large doses; retained since HQs>50 at a number of locations.
Beryllium	9	11 of 51 receptor categories had HQs>=1	No	Slightly above background and EBSL, found only at one WAG, removed as OU 10-04 COPC
Boron	3	2 of 51 receptor categories had HQs>=1, the pygmy rabbit had an HQ=2, and plants had an HQ = 100+	No	COPC a problem at only one WAG and one site (CPP-66, Fly Ash Pit)
Cadmium	1,2,3,4,5, 9, 6/10	31 of 51 receptor categories had HQs>=1 ^a	Yes	Eisler 1985a; toxic; bioaccumulation potential
Chlorine	3	No toxicity value developed and no HQs were calculated	No	Only present at one WAG and no further information listed for the presence of chlorine in WAG 3
Chloride	6/10	HQs were calculated but analyte removed as a COPC	No	See footnotes in Appendix C and discussion in Appendix K.
Chromium III	1,2,3,4,5, 9,6/10	16 of 51 receptor categories had HQs>=1 ^a	Yes	Eisler 1986a, site 9 for all receptors; bioaccumulation potential
Chromium VI	1,3,4,5,9	15 of 51 receptor categories had HQs>=1	Yes	Eisler 1986a; toxic; bioaccumulation potential
Cobalt	1,5,9,6/10	22 of 51 receptor categories had HQs>=1 ^a	Yes	
Copper	1,2,4,5,9, 6/10	24 of 51 receptor categories had HQs>=1 ^a	Yes	Essential nutrient; low bioaccumulation potential

Table H2-1. (continued).

Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
Cyanide	1,3,9	9 out of 51 receptors had HQs ≥ 1 at WAG 1, 27 out of 51 receptors had HQs ≥ 1 at WAG 9	Yes	Slightly above EBSL at two of the three WAG sites; toxic and common contaminant at CERCLA sites
Fluoride	1,2,3	22 of 51 receptor categories had HQs ≥ 1	No	Above background and EBSL at three sites; see Appendix C
Lead	1,2,3,4,5, 9,6/10	27 of 51 receptor categories had HQs $\geq 1^a$	Yes	Eisler 1988; may uptake into plants and transfer to other receptors
Manganese	1,9,6/10	17 of 51 receptor categories had HQs $\geq 1^a$	Yes	Above background and EBSL at two sites
Mercury	1,2,3,4,5, 9,6/10	36 of 51 receptor categories had HQs $\geq 1^a$	Yes	Eisler 1987a; bioaccumulation potential
Molybdenum	None	No HQs ≥ 1 for any receptor category	No	Not shown to be present at any site
Nickel	1,3,4,5,9	19 of 51 receptor categories had HQs ≥ 1	Yes	ATSDR 1988a; bioaccumulation potential
Nitrate	4,6/10	3 of 51 receptor categories had HQs $\geq 1^a$ at WAG 4 (however, HQs were less than 2). 8 of 51 receptor categories had HQs ≥ 1 at WAG 10, however all HQs were less than 5.	No	Nitrate is an inorganic mineral form of nitrogen readily taken up by plants. It is eliminated due to its low HQs and toxicity.
Nitrite	6/10	4 of 13 receptors evaluated under WAG 10 had HQs $\geq 1^a$, but all HQs were less than 2.	No	Nitrite occurs as intermediate form of nitrate. Usually nitrite does not accumulate in soil because it is rapidly transformed to nitrate or is denitrified.
Phosphate	3,9	No toxicity value developed and no HQ values calculated, estimated to be present in CPP-67 effluent. However, no value was available for quantitative analysis.	No	Only found at one site at each WAG; no information about phosphate at WAG 3; common fertilizer. Phosphorous is an essential element for plant growth.
Selenium	1,2,3,4,5, 9,6/10	34 of 51 receptor categories had HQs $\geq 1^a$	Yes	Eisler 1985b; essential nutrient; toxic, bioaccumulation potential
Silver	1,2,3,4,5, 9	21 of 51 receptor categories had HQs ≥ 1	Yes	ATSDR 1990b; low bioaccumulation potential; toxic
Sodium	1,4,5,9	13 of 51 receptor categories had HQs ≥ 1 , HQs ≥ 10 at WAGs 4, 5 and 9. However HQs ≥ 20 at only WAG 5 for mammalian herbivores (HQ approximately 25).	No	Unless sodium concentrations greatly exceed dietary requirements remove as a COPC; macronutrient
Strontium	1,2,3,6/10	7 of 51 receptor categories had HQs $\geq 1^a$	Yes	

Table H2-1. (continued).

Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
Sulfate	9	26 of 51 receptor categories had HQs >= 1	No	Only found having HQs <= 2 at one site at one WAG. Often used in ammonia sulfate as fertilizer.
Sulfide	3	No toxicity value developed and no HQ values calculated	No	Only found at one site at one WAG
Thallium	1,2,5,9,6/10	21 of 51 receptor categories had HQs >= 1 ^a	Yes	ATSDR 1990a; taken up by plants; bioaccumulation potential; toxic
Tin	1	13 of 51 receptor categories had HQs >= 1	No	Only found at one WAG with HQs >= 1; organotin compounds may bioaccumulate and are more toxic, especially in aquatic systems
Vanadium	1,2,5,9,6/10	19 of 51 receptor categories had HQs >= 1 ^a	Yes	
Zinc	1,2,4,5,9,6/10	29 of 51 receptor categories had HQs >= 1 ^a	Yes	ATSDR 1988b; essential nutrient; bioaccumulation potential
Organics				
1,1,1-Trichloroethane	None	No HQs >= 1 for any receptor category at WAG 2	No	
1,3-Dinitrobenzene	6/10	2 of 13 receptors evaluated under WAG 10 had HQs >= 1 ^a	Yes	This compound is a byproduct of biodegraded 2,4,6-TNT and is considered to be less toxic; however, it is retained at the OU 10-04 level since WAG 10 encompasses many sites where this contaminant is likely to be found.
1,3,5-Trinitrobenzene	6/10	2 of 13 receptors evaluated under WAG 10 had HQs >= 1 ^a	Yes	This compound is a byproduct of biodegraded 2,4,6-TNT and is considered to be less toxic; however it may be a potential contaminant of concern for post-remediation confirmation sampling at ordnance sites.
1,4-Dichlorobenzene	1	No toxicity data available and no HQs were calculated	No	Most likely volatilized by now and located in only one WAG; 0.009 mg/kg max. conc
2-Methylnaphthalene	1	13 of 51 receptor categories had HQs >= 1	Yes	Present at two sites; 290 mg/kg max. conc.; persistent; may be present at the WAG 10 fuel spill sites.
2,4-Dimethylphenol	None	No HQs >= 1 for any receptor category	No	

Table H2-1. (continued).

	Contaminant	WAG	HQ and EBSL Discussion	Retain	References and Comments
				COPC	
H2-6	2,4-Dinitrotoluene	6/10	2 of 13 receptors evaluated under WAG 10 had HQs \geq 1 ^a	Yes	This compound is a byproduct of biodegraded 2,4,6-TNT and is considered to be less toxic; however, it is retained at the OU 10-04 level since WAG 10 encompasses many sites where this contaminant is likely to be found
	2,6-Dinitrotoluene	6/10	1 of 13 receptors had HQs \geq 1 for WAGs 6&10	Yes	May be a potential contaminant of concern for post-remediation confirmation sampling at ordnance sites.
	4-Amino-2,6-dinitrotoluene	6/10	2 of 13 receptors had HQs \geq 1 for WAGs 6&10	Yes	May be a potential contaminant of concern for post-remediation confirmation sampling at ordnance sites.
	2-Amino-4,6-dinitrotoluene	6/10	No HQs \geq 1 for any receptor category	Yes	No sites with HQs \geq 1 for this contaminant; however it may be a potential contaminant of concern for post-remediation confirmation sampling at ordnance sites.
	2,4,6-Trinitrotoluene	6/10	3 of 13 receptors evaluated under WAG 10 had HQs \geq 1 ^a	Yes	
	4,4-DDT	None	No HQs \geq 1 for any receptor category at WAG 1.	No	
	4-chloroaniline	3	3 of 51 receptor categories had HQs \geq 1	No	Present at only at CPP-14 (this site will be remediated by removal and onsite disposal); volatile; low bioaccumulation potential
	4-Methyl-4-hydroxy-2-pentanone	None	No HQs \geq 1 for any receptor category	No	
	Acenaphthene	None	No HQs \geq 1 for any receptor category	No	
	Acetone	2,3,4	6 of 51 receptor categories had HQs \geq 1	No	Acetone is a volatile compound that occurs naturally in plants, trees, volcanic gases, and forest fires. Microbes in soil remove part of the acetone in soil. Some is lost from soil by evaporation and biodegradation. Acetone molecules do not bind tightly to soil. Rainwater and melted snow dissolve acetone and carry it deeper into the soil. Acetone also has a low bioaccumulation potential and is eliminated as an OU 10-04 COC.

Table H2-1. (continued).

Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
Aroclor-1248	5	No HQ ≥ 1 for any receptor category	Yes	Present at only one WAG; bioaccumulation potential; lipophilic, persistent.
Aroclor-1254	1,2,3,4,5,9	16 of 51 receptor categories had HQs ≥ 1 only at WAG 5, WAGs 2 and 4 assessed as PCB.	Yes	Present at HQs of possible concern at only one WAG; bioaccumulation potential; lipophilic, persistent, SPERT-IV Lake (20,092m ²) no action, present at low levels at multiple WAG sites.
Aroclor-1260	1,2,4,9	3 of 51 receptor categories had HQs ≥ 1 for WAG 1, WAGs 2, 4 and 9 assessed as PCB.	Yes	Eisler 1986b; bioaccumulation potential; lipophilic, persistent, present at low levels at multiple WAGs.
Benzene	4	6 of 51 receptor categories had HQs ≥ 1	No	Present at only one WAG; volatile; low bioaccumulation potential
Benzo(a)anthracene	None	No HQs ≥ 1 for any receptor category	No	
Benzo(a)pyrene	3,4	3 of 51 receptor categories had HQs ≥ 1 ; HQs ≤ 1 at WAG 3,4	No	Eisler 1987b, values less than the EBSLs for WAG 6/10; lipophilic, persistent
Benzo(b)fluoranthene	1,4	8 of 51 receptor categories had HQs ≥ 1 ; all receptors at WAGs 1 and 4 have HQs < 5 , 0.3 mg/kg max. conc. at WAG 1; 0.89 mg/kg max. conc. at WAG 4, below newer EBSLs at both WAGs	No	Eisler 1987b, generally can be grouped with the other polycyclic aromatic hydrocarbons; values for similar PAHs are below the EBSLs for WAG 6/10; lipophilic, persistent.
Benzo(g,h,i)perylene	1,3,4	1 of 51 receptor categories had HQs ≤ 2 at WAG 4; HQs < 1 at WAG 3 and WAG 1.	No	Generally can be grouped with the other polycyclic aromatic hydrocarbons; values for similar PAHs are below the EBSLs for WAG 6/10; lipophilic, persistent
Benzo(k)fluoranthene	1,3,4	5 of 51 receptor categories had HQs ≤ 4 at WAG 1; HQs < 1 at WAG 3; 5 of 51 receptor categories had HQs ≤ 3 at WAG 4.	No	Generally can be grouped with the other polycyclic aromatic hydrocarbons; values for similar PAHs are below the EBSLs for WAG 6/10; lipophilic, persistent
Butylbenzylphthalate	None	No HQs ≥ 1 for any receptor category	No	
Carbon tetrachloride	None	No HQs ≥ 1 for any receptor category	No	

Table H2-1. (continued).

H2-8	Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
	Chloromethane	1,4,6/10	No toxicity data available and no HQ values calculated	No	Most likely volatilized by now; concentrations are low, 0.002 mg/kg max conc. at WAG 6/10; 0.01 mg/kg max. conc. at WAG 1; 0.005 mg/kg max. conc. at WAG 4
	Chrysene	3,4	9 of 51 receptor categories had HQs \geq 1; HQs < 1 at WAG 3	No	Generally can be grouped with the other polycyclic aromatic hydrocarbons; values for similar PAHs are below the EBSLs for WAG 6/10; lipophilic, persistent, WAG 4 is the only site that appears to have significant chrysene concentrations.
	Dibenzofuran	4	Detected below EBSL, no calculated	No	Present at only one site
	Dichlorodifluoromethane	1	No toxicity value available and no HQ values calculated	No	Most likely volatilized by now; present at only one site; 0.012 mg/kg max. conc.
	Di(2-ethylhexyl)phthalate (same as bis(2-ethylhexyl phthalate))	1, 3	3 of 51 receptor categories had HQs \leq 1; very low HQs	No	Values slightly above EBSLs and HQ values were very low; bioaccumulation potential; possible lab contaminant; 3.9 mg/kg max. conc. at WAG 1
	Di-n-butylphthalate	None	No HQs \geq 1 for any receptor category	No	
	Di-n-octylphthalate	None	No HQs \geq 1 for any receptor category	No	
	Fluoranthene	None	No HQs \geq 1 for any receptor category	No	
	Indeno(1,2,3cd)pyrene	3,4	3 of 51 receptor categories had HQs=1 at WAG 4; HQs < 1 at WAG 3	No	Generally can be grouped with the other polycyclic aromatic hydrocarbons; values for similar PAHs are below the EBSLs for WAG 6/10; bioaccumulation potential
	HMX	6/10	2 of 13 receptors evaluated under WAG 10 had HQs \geq 1 ^a	Yes	See Appendix G. CoPC may be present at other ordnance sites; however it may be a potential contaminant of concern for post-remediation confirmation sampling at ordnance sites.
	HpCDD	9	No toxicity value available and no HQ values calculated	No	Present at only one site.
	Methylene chloride	4	3 of 51 receptor categories had HQs \geq 1	No	Found at only one site; volatile; possible lab contaminant

Table H2-1. (continued).

Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
Naphthalene	1,2,4	3 of 51 receptor categories had HQs <=2 at WAG 4 All other HQs are <1	No	Lipophilic, persistent; all very low HQs ≤ 1.
OCDD	9	No toxicity value available and no HQ values calculated	No	Found at only one site; 1.00E-05 mg/kg max. conc.
PCBs	2,3	No HQs >=1 for any receptor category but conc. > EBSL	Yes	Persistent, potential for bioaccumulation.
Pentachlorophenol	4,6/10	No HQ values calculated for WAG 4 ; found at only one WAG 4 site (CFA-12)	No	Highest HQ at NODA #2 (WAGs 6&10) was 2.7.
Phenanthrene	4	No HQs >=1 for any receptor at WAG 4	No	
Propionitrile	1	No toxicity value available and no HQ values calculated	No	Most likely volatilized by now; found at only one site; 0.02 mg/kg max. conc.
Pyrene	None	No HQs >=1 for any receptor category	No	
RDX	6/10	4 of 13 receptors evaluated under WAG 10 had HQs>=1 ^a	Yes	Retained at the OU 10-04 level since WAG 10 encompasses many sites where this contaminant is likely to be found
Tetrachloroethylene	4	5 of 51 receptor categories had HQs<=4	No	Found at only one site; volatile; possible lab contaminant
Tetrahydrofuran	1	29 of 51 receptor categories had HQs>=1; high HQs	No	Likely volatilized by now, very short half-life; volatile; 0.022 mg/kg max. conc.
Toluene	4	10 of 51 receptor categories had HQs>=1	No	Found only at one site; volatile; possible lab contaminant
TPH	1,4,6/10	19 of 51 receptor categories had HQs>=1; HQs up to 200 (WAG 1)	Yes	Found at multiple sites; some fuel compounds are volatile
Vinyl acetate	1	No toxicity value available and no HQ values calculated	No	Likely volatilized by now; found only at one site; 0.003 mg/kg max. conc.
Xylene	1,2,3,4	14 of 51 receptor categories had HQs>=1	Yes	Likely volatilized by now but was found at multiple sites
Radionuclides				
Am-241	2,3		Yes	
Co-60	3		Yes	
Cs-134	2		Yes	

Table H2-1. (continued).

Contaminant	WAG	HQ and EBSL Discussion	Retain COPC	References and Comments
Cs-137	2,3		Yes	
Eu-152	3		Yes	
Eu-154	3		Yes	
Pu-238			Yes	
Pu-239	3		Yes	
Pu-239/240	3		Yes	
Sr-90	2,3		Yes	
U-235	3		Yes	
U-238			Yes	
Tritium	9		Yes	Potential contaminant in groundwater

TBD = to be determined

a. The WAG 6 & 10 ERA did not evaluate ecological receptors based on receptor categories, but rather as individual receptors. These individual receptors found on WAG 6 & 10 sites were chosen across as many receptor categories as possible.

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